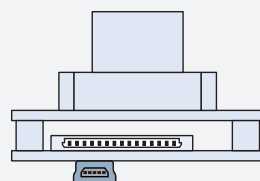
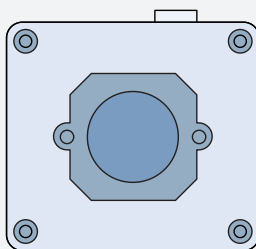
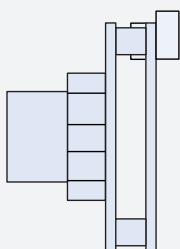
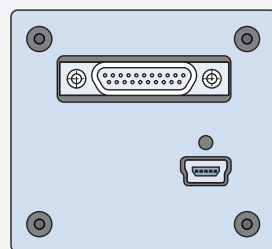
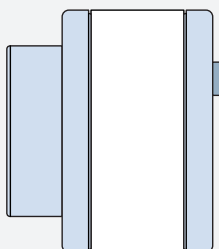
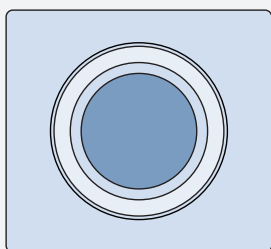


VRmagic

USB Cameras

User Guide



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Subject to change without notice. Errors excepted.

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Table of Contents

1	General Information	6
2	Overview.....	7
2.1	Camera Models	7
2.2	Connectors and Interfaces	10
2.3	Accessories	13
3	Software Installation	14
3.1	Downloading the SDK	14
3.2	Installing the SDK	14
3.3	Contents of the SDK.....	15
3.3.1	Windows.....	15
3.3.2	Linux.....	16
4	Hardware Installation.....	17
4.1	Connecting External Sensor Boards	17
4.2	Connecting the Interface Cables.....	19
4.2.1	Cameras with Hirose DF14-15P Connector.....	19
4.2.2	Cameras with MPE Garry Micro-T Connector.....	21
4.2.3	Compact Single-Sensor Cameras	22
4.3	Connecting to Power.....	22
4.3.1	Power Supply via USB	23
4.3.2	External Power Supply	23
5	First Steps	25
5.1	Auto-Detection of the Camera	25
5.2	Starting CamLab.....	25
5.3	Accessing the Demo Applications	27
5.4	Using Trigger and Strobe	28
5.4.1	Trigger Input.....	29
5.4.2	Strobe Output	30

6	Firmware Update.....	31
7	Appendix.....	33
7.1	Cable Plan VRmC-X OEM Interface Cable	33
7.2	Cable Plan VRmDC/FC-X-DF14-Open.....	34
7.3	Cable Plan VRmC-X PRO Interface Cable	35
7.4	Pinout 4-pin Header VRmC-X+ OEM/COB	36
7.5	Status LED Indications	37
8	Index.....	38

1 General Information

This guide applies to all USB cameras from VRmagic. Follow this guide chapter by chapter to set up and understand your device. If a section of this document only applies to certain camera models, this is indicated at the beginning of the respective section.

Symbols Used

This guide makes use of a few symbols and conventions:



Warning!

Indicates a situation which, if not avoided, could result in minor or moderate injury and/or property damage or damage to the device.



Caution

Indicates a situation which, if not avoided, may result in minor damage to the device, in malfunction of the device or in data loss.



Note

Notes provide information on special issues related to the device or provide information that will make operation of the device easier.

This headline indicates the beginning of a procedure:

1. This number indicates the first step of a certain procedure you are expected to follow. Following steps are numbered accordingly.
 - ▶ This arrow indicates an expected result of your action.
- ➞ This symbol indicates a reference to a different part of this manual or to external documents.

2 Overview

2.1 Camera Models

Single-Sensor Cameras VRm(F)C-X

Single-sensor cameras are equipped with one image sensor. The sensor board is mounted directly to the camera base unit, forming one compact unit. They are available as board-level cameras (OEM versions), board-level cameras with optics (COB versions) and as cameras with aluminium housing (PRO versions).

All cameras are equipped with a sensor board and an interface board. Depending on the image sensor, the camera may be equipped with an additional FPGA board (VRm-FC-X models).

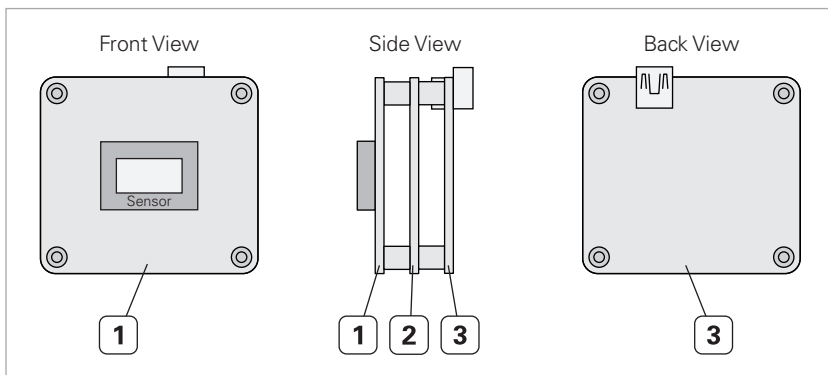


Fig. 1: USB single-sensor camera (OEM) with FPGA board

- 1** Sensor board with image sensor
- 2** FPGA board (VRmFC-X cameras only)
- 3** Interface board

Compact Single-Sensor Cameras VRmC-X+

Compact single-sensor cameras consist of one single board only, making them very small. They are equipped with one image sensor and are available as board-level cameras (OEM versions), board-level cameras with optics (COB versions) and as cameras with aluminium housing (PRO versions).

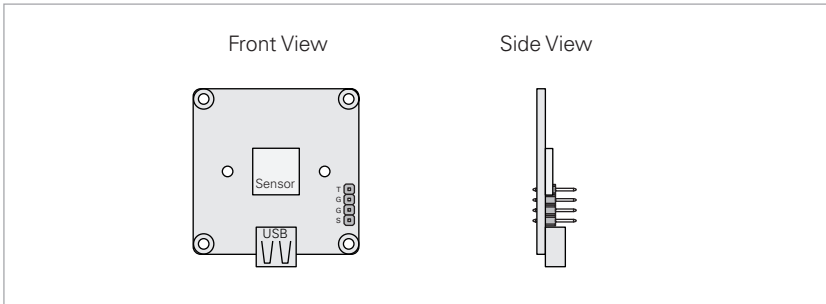


Fig. 2: Compact USB single-sensor camera (OEM)

Remote-Sensor Cameras VRmC-X-E

Remote-sensor cameras consist of a base unit and an external sensor board connected to the base unit by flex-foil cable. Remote-sensor cameras are available as board-level cameras (OEM versions) and board-level cameras with optics (COB versions).

The base unit consists of a sensor connection board and an interface board.

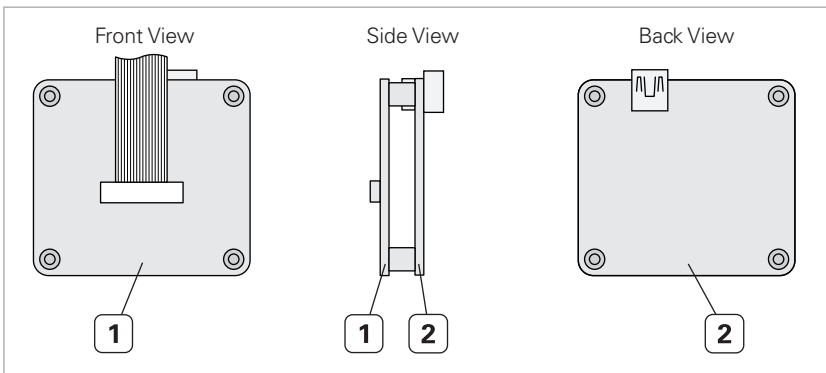


Fig. 3: Base unit of USB remote-sensor camera

- 1 Sensor connection board (external sensor board is connected via flex-foil cable)
- 2 Interface board

Multi-Sensor Cameras VRmMFC

Multi-sensor cameras consist of a base unit and up to four external sensor boards connected to the base unit by flex-foil cables. They are available as board-level cameras (OEM versions) and board-level cameras with optics (COB versions).

The base unit consists of a sensor connection board, an FPGA board, and an interface board.

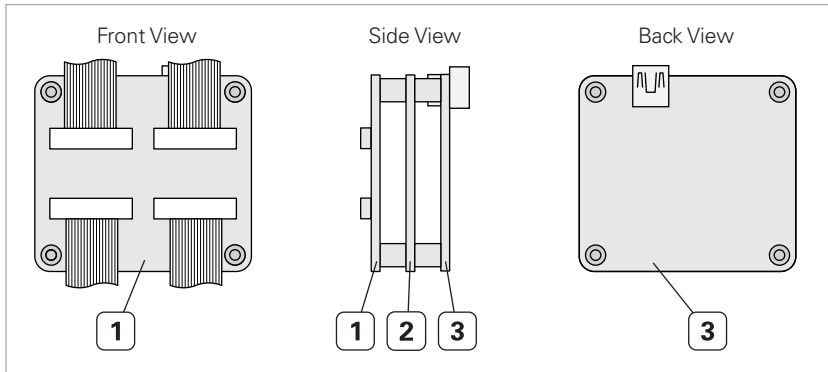


Fig. 4: Base unit of USB multi-sensor camera with standard interface board

- 1** Sensor connection board (external sensor boards are connected via flex-foil cables)
- 2** FPGA board
- 3** Interface board

2.2 Connectors and Interfaces

Depending on your camera model, the available interfaces vary in type and position. There are basically three different interface configurations, which are described in the following.

Single-/Remote-/Multi-Sensor Cameras OEM and COB

Single-sensor cameras, remote-sensor cameras, and multi-sensor cameras in OEM and COB versions are equipped with a USB connector, a Hirose DF14-15P connector for trigger/strobe and external power supply, and a status LED (➡ Fig. 5 on page 10).

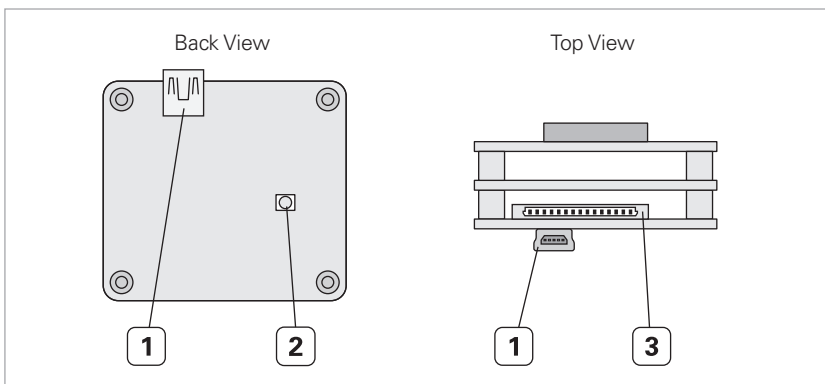


Fig. 5: Interfaces of a single-sensor camera VRmFC-X OEM

- 1** USB Mini-B port
- 2** Status LED
- 3** DF14-15P connector for trigger, strobe, and external power supply

Single-Sensor Cameras PRO

Single-sensor cameras in PRO version are equipped with a USB connector, an MPE Garry Micro-T connector for trigger/strobe and external power supply, and a status LED (➡ Fig. 6 on page 11).

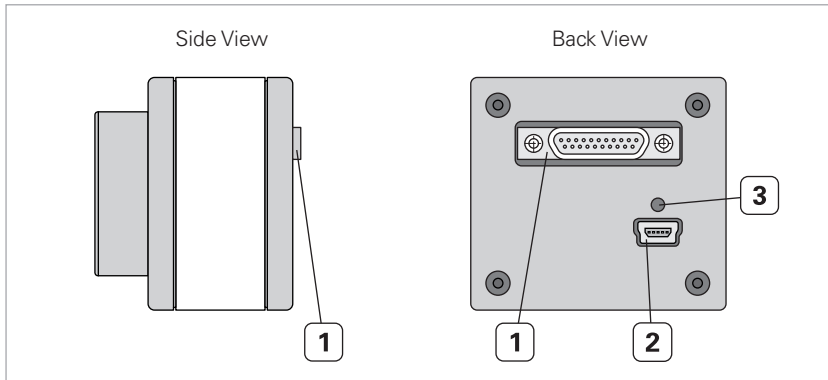


Fig. 6: Interfaces of a single-sensor camera VRmC-X PRO

- 1** MPE Garry Micro-T 386-2-021-ZS0 connector for trigger, strobe, and external power supply
- 2** USB Mini-B port
- 3** Status LED

Compact Single-Sensor Cameras

Compact single-sensor cameras: PRO variants are equipped with a USB connector (➡ Fig. 7 on page 12). OEM and COB variants also feature an additional 4-pin header for trigger/strobe and a status LED (➡ Fig. 7 on page 12).

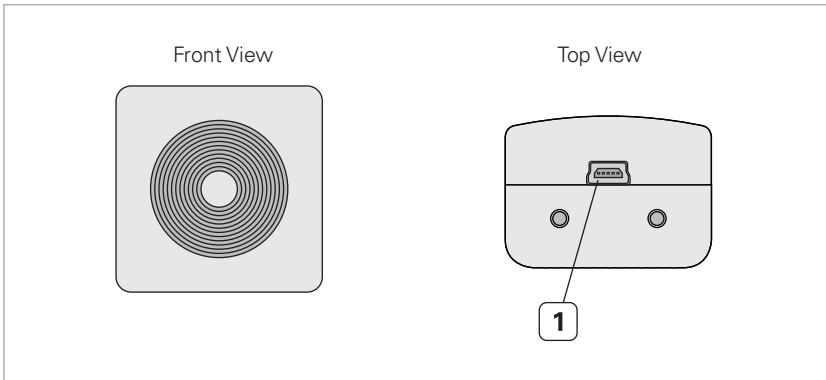


Fig. 7: Interfaces of a compact single-sensor camera VRmC-X+ PRO

1 USB Mini-B port

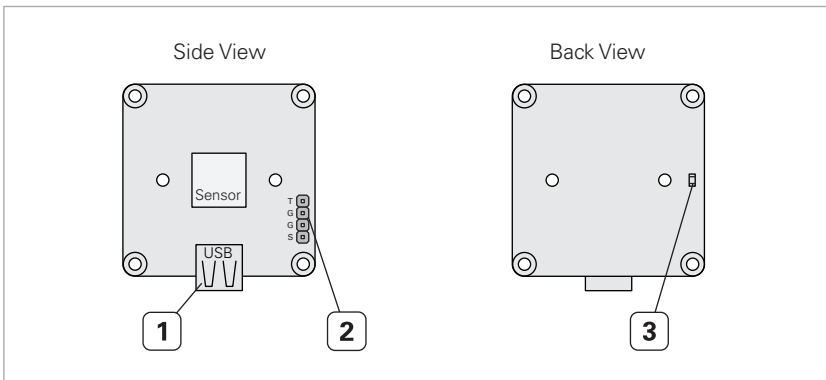


Fig. 8: Interfaces of a compact single-sensor camera VRmC-X+ OEM

- 1 USB Mini-B port
- 2 4-pin header for trigger and strobe
- 3 Status LED

2.3 Accessories

Accessory	Description
VRmDC/FC-X-DF14-Open	Interface cable with Hirose DF14 plug on one end and open wires at the other end (➡ Fig. 12 on page 20). For all board-level cameras (OEM and COB) except compact single-sensor cameras.
VRmC-X OEM Interface Cable	Interface cable with Hirose DF14 plug on one end and different adapters on the other end (➡ Fig. 11 on page 20). For all board-level cameras (OEM and COB) except compact single-sensor cameras.
VRmC-X PRO Interface Cable	Interface cable with MPE Garry Micro-T plug on one end and different adapters on the other end (➡ Fig. 13 on page 21). For all housing cameras (PRO) except compact single-sensor cameras.
1 Power supply 5 V / 15 W worldwide	Power supply for all cameras except compact single-sensor cameras.

3 Software Installation

3.1 Downloading the SDK

Downloading the software package:

1. Visit www.vrmagic.com/imaging/downloads/ .
 - ▶ The software for USB cameras can be found below the heading “Software for USB Components”.
2. Depending on the operating system where you plan to install the package (Linux or Windows, 32 bit or 64 bit), download the .zip file **VRmUsbCam DevKit for Windows ...** or the .tar.bz2 file **VRmUsbCam DevKit for Linux ...** .
3. Unpack the downloaded file.

3.2 Installing the SDK



Note

You may install both the 32 bit version (X86) and the 64 bit version (X64) of the SDK in parallel, if required.

Installing the software development kit (Windows):

1. Navigate to the directory you just unpacked.
2. To install the SDK, run **setup.exe**.
3. Follow the on-screen instructions.
 - ▶ After successful installation a message is displayed. A new folder **VRmagic** was created in your Windows start menu. Several folders were created on your hard drive (➔ 3.3.1 on page 15).

Installing the software development kit (Linux):

1. Navigate to the directory you just unpacked.
2. To install the SDK, execute `./VRmUsbCamDevKitForLinuxX**-install` as root (** = 64 or 86). For further information, refer to the **README** file in the same directory. Several folders were created on your hard drive (➔ 3.3.2 on page 16).

3.3 Contents of the SDK

3.3.1 Windows

While installing the SDK, the following directories were created on your PC. Drive letters and paths may vary depending on your system and installation instructions.

32 bit: C:\Program Files (x86)\VRmagic\ 64 bit: C:\Program Files\VRmagic\	
USB driver	VRmagic USB driver installation files
VRmUsbCam	VRmUsbCam and tools
CamLab	Camera application with control and viewer window
CamServer	Camera application for Ethernet transmission
Install	Install scripts for COM API & DirectShow, Ethernet PnP enable script
weblinks	Links to VRmagic website

32 bit: C:\Program Files (x86)\Common Files\VRmagic\VRmUsbCamSDK\ 64 bit: C:\Program Files (x86)\Common Files\VRmagic\VRmUsbCamSDK\	
demos	Demo applications
docs	Product documentation
include	Include file for using the shared library
lib	Shared library
vm_lib	Library for image processing
vsprops	Property Sheets for Visual Studio (C++)
wrappers	C++ and .NET wrappers

3.3.2 Linux

Directory structure of the SDK distribution (Linux)	
camlab	Camera application with control and viewer window
vrncamserver	Camera application for Ethernet transmission
demos	Demo applications
deviceinfo	Demo application displaying device information
restorefactory defaults	Demo application that restores all factory defaults
sdlviewer	Demo application displaying the camera pictures in an SDL widget
docs	vrncam API documentation
include	Include file for using the shared library
lib	Shared library
share	
fpgaprogramfiles	
setup	Setup scripts, hotplug helper and ethernet enable/disable scripts
udev	udev rules file which invokes the hotplug helper
etc	Potential contents of /etc/vrmagic

4 Hardware Installation

4.1 Connecting External Sensor Boards

**Note**

This section only applies to remote-sensor cameras and multi-sensor cameras.

Remote-sensor cameras and multi-sensor cameras consist of a base unit and up to four external sensor boards. The external sensor boards have to be connected to the base unit using the supplied flex-foil cables.

**Caution**

Possible malfunction of camera

Observe the correct orientation of the flex-foil cable contacts as indicated in the instructions and the drawings. Otherwise the device will not function.

Connecting the flex-foil cable(s) to the base unit:

1. Pull out the lock of the connector on the base unit (➡ Fig. 9 on page 17).
2. Insert the flex-foil cable with the visible contacts showing away from the board.
3. Secure the cable by pushing the lock back in.
4. Repeat steps 1 to 3 for further external sensor boards.

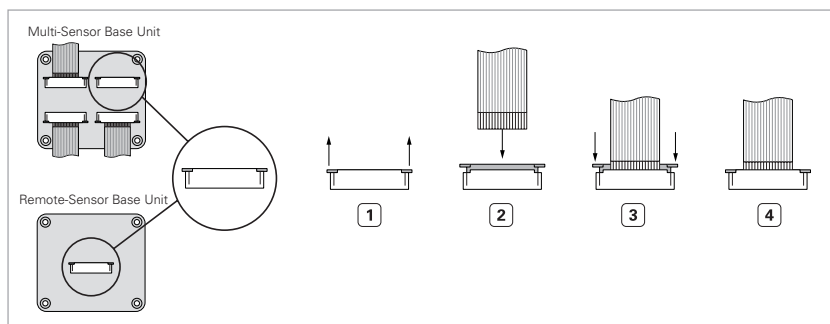


Fig. 9: Connecting the flex-foil cable to the base unit

Connecting the flex-foil cable(s) to the sensor board(s):

1. Pull out the lock of the connector on the sensor board (➡ Fig. 10 on page 18).
2. Insert the flex-foil cable with the blue marker showing away from the sensor board and the contacts facing the sensor board.
3. Secure the cable by pushing the lock back in.
4. Repeat steps 1 to 3 for further external sensor boards.

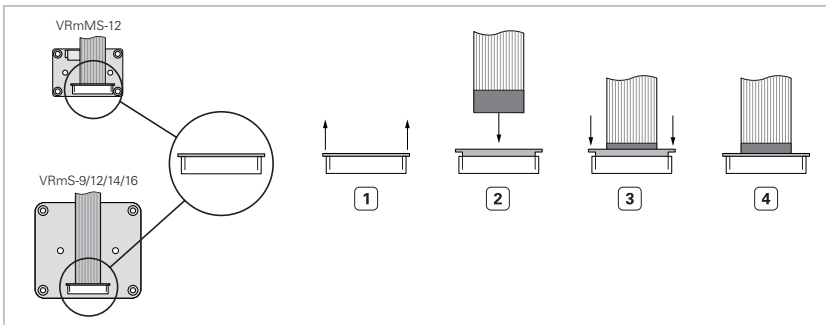


Fig. 10: Connecting the flex-foil cable to the sensor board

4.2 Connecting the Interface Cables

4.2.1 Cameras with Hirose DF14-15P Connector

**Note**

The following instructions apply to cameras equipped with a Hirose DF14 connector only. These are

- all multi-sensor cameras VRmMFC,
- all remote-sensor cameras VRmC-X-E,
- all board-level single-sensor cameras VRm(F)C-X.

It is assumed that you have ordered one of the optional cables “VRmDC/FC-X-DF14-Open” or “VRmC-X OEM Interface Cable” (➔ 2.3 on page 13).

Connecting the camera:

1. Connect the supplied cable with the Hirose DF14 plug to the camera's receptacle (➔ 2.2 on page 10).
2. The other end of the cable splits into open ends or receptacles for trigger, strobe, and external power supply, depending on the accessory kit you ordered (➔ Fig. 10 on page 18). Connect trigger and strobe, if required.
 - ▶ View the cable plan for a detailed description (➔ 7.1 on page 33).
3. Connect the USB cable to the camera's USB port.
4. Continue with ➔ 4.3 on page 22 and read the information on power supply.

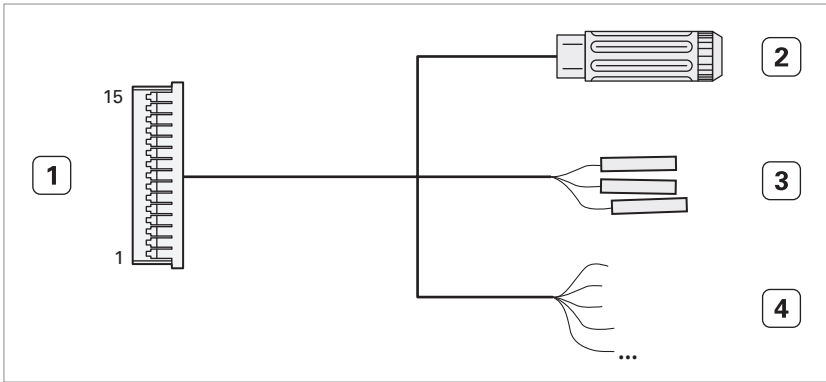


Fig. 11: VRmC-X OEM interface cable for OEM and COB cameras

- 1 Hirose DF14-15S-1.25C, to be plugged into camera receptacle
- 2 Switchcraft PC722A receptacle for 5 V power supply
- 3 Receptacles for 0.1" connector (3 pieces)
- 4 Open ends (8 pieces, reserved)



Fig. 12: VRmDC/FC-X-DF14-Open interface cable for OEM and COB cameras

- 1 Hirose DF14-15S-1.25C, to be plugged into camera receptacle
- 2 Open ends (15 pieces)

4.2.2 Cameras with MPE Garry Micro-T Connector



Note

The following instructions apply to cameras equipped with a MPE Garry Micro-T connector only. These are

- all single-sensor cameras in PRO design VRm(F)C-X.

It is assumed that you have ordered the optional “VRmC-X PRO Interface Cable” (➔ 2.3 on page 13).

Connecting the camera:

1. Connect the supplied cable with the MPE Garry Micro-T plug to the camera's receptacle (➔ 2.2 on page 10).
2. The other end of the cable splits into 0.1" receptacles for trigger and strobe and a receptacle for an external power supply. Connect trigger and strobe, if required.
► View the cable plan for a detailed description (➔ 7.3 on page 35).
3. Connect the USB cable to the camera's USB port.
4. Continue with ➔ 4.3 on page 22 and read the information on power supply.

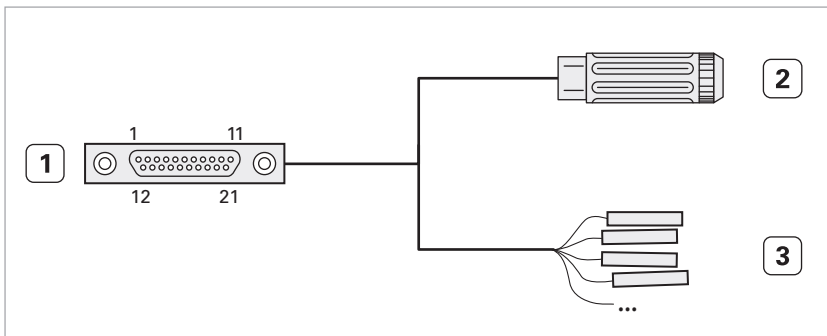


Fig. 13: VRmC-X PRO interface cable for PRO cameras

- 1 MPE Garry Micro-T 387-1-021-ZS0, to be plugged into camera receptacle
- 2 Switchcraft PC722A receptacle for 5 V power supply
- 3 Receptacles for 0.1" connector (7 pieces)

4.2.3 Compact Single-Sensor Cameras

**Note**

The following instructions apply to compact single-sensor cameras only. These are

- all cameras VRmC-X+ in OEM, COB, or PRO design.

Connecting the camera:

1. OEM and COB cameras only: if required, connect trigger and strobe to the 4-pin header.
 - ▶ View the cable plan for a detailed description (➔ 7.4 on page 36).
2. Connect the USB cable to the camera's USB port.
3. Continue with ➔ 4.3 on page 22 and read the information on power supply.

4.3 Connecting to Power

Most cameras can be powered via the USB connection without external power supply. Only specific multi-sensor camera models require an external power supply.

**Caution**

Additional external power supply necessary with specific multi-sensor cameras

In case you are operating a multi-sensor camera with the sensor boards VRmS-9 or VRmS-14, connect an external power supply to the camera as described in the following.

Only if you are using a multi-sensor camera with the VRmS-12 sensor boards you may supply the camera via the USB connection.

4.3.1 Power Supply via USB

Note

We recommend attaching the USB cable(s) of the camera(s) directly to the PC mainboard without any other high power USB devices connected at the same time. Alternatively, use an active USB hub. Passive USB hubs or to USB ports on the front panel of your PC will most probably not provide enough power.

If you plan to connect a larger number of USB cameras to the same PC, the power supplied by the USB ports may not be sufficient. In this case, power the cameras externally.

Connecting the camera to power via USB:

1. Connect the USB cable connected to the camera to a USB port of your host PC.
 - ▶ The status LED starts blinking.
 - ▶ If you have installed the camera software, the camera should be detected automatically by the host PC. When Windows XP complains about missing WHQL certification of the driver, click **Continue Anyway** to complete installation
 - ▶ The camera is ready to use and the status LED should be on permanently.

4.3.2 External Power Supply

Multi-sensor cameras with the sensor boards VRmS-9 or VRmS-14 have to be connected to an external power supply. For all other cameras, this is optional.

Use the power supply adapter PHIHONG PSA 15R-050P, if ordered as accessory. Alternatively, use a power supply with the same output values (5 V DC, 15 W).

Note

Depending on the accessory kit you ordered, the external power supply has to be connected to cables with open ends, or to a 5 V receptacle.

Connecting the camera to an external power supply:

1. Connect the power supply adapter to power.
2. Connect the power supply cable to the camera's power inlet.

3. If not already happened, connect the USB cable connected to the camera to a USB port of your host PC.
 - ▶ The status LED starts blinking.
 - ▶ If you have installed the camera software, the camera should be detected automatically by the host PC. When Windows XP complains about missing WHQL certification of the driver, click **Continue Anyway** to complete installation
 - ▶ The camera is ready to use and the status LED should be on permanently.

5 First Steps

5.1 Auto-Detection of the Camera

If the camera was detected successfully and is operational, the camera's status LED should be on permanently. If the status LED continues to blink, this indicates that the camera was not detected successfully or is not supplied with enough power. In this case, check that the software was installed correctly or try using a different USB port, which supplies more power.

For a detailed description of the status LED, refer to ➔ 7.5 on page 37.

5.2 Starting CamLab

Start the CamLab application to test the functionality of your camera. With CamLab you can select the cameras connected to your host PC, view the image recorded by the image sensor, and change all available camera parameters.

1. Start the CamLab application (Windows: **Start > All programs > VRmagic > CamLab**).
 - ▶ Your camera should be listed in the **device** list (model name and serial number).

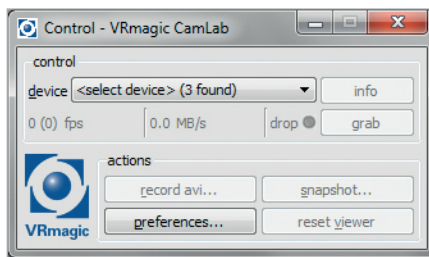


Fig. 14: CamLab with device list

2. Select your camera from the **device** list.
 - ▶ The CamLab control window now displays additional information and camera parameters. An additional viewer window is also displayed.

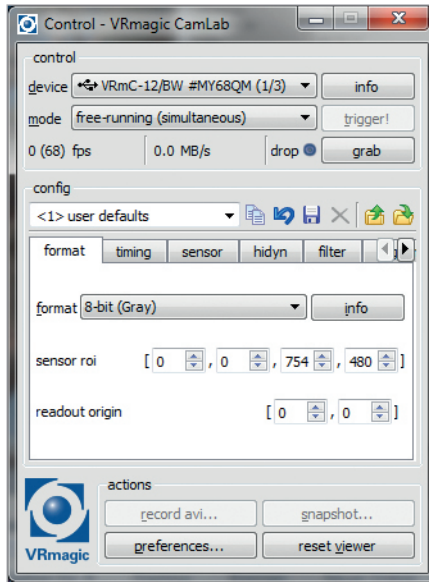


Fig. 15: Camera selected in CamLab

3. Choose **grab** to view the camera image.
 - The camera image is displayed in the viewer window.
4. Try out the different camera parameters. You can change and save parameters in the **config** area.

5.3 Accessing the Demo Applications



Note

The SDK directory, which is normally C:\Program Files (x86)\Common Files\VRmagic\VRmUsbCamSDK\ is read-only. We recommend copying the complete directory including subdirectories to your user directory for testing and development.

Accessing the demo applications under Windows:

1. Navigate to the folder `your-path-to\VRmUsbCamSDK\demos\`.
2. Open the subdirectory for your development platform.
 - ▶ All demo applications are located there.

Accessing the demo applications under Linux:



Note

To build the demos, you need the SDL library including the development package installed on your system (SDL and SDL-devel packages).

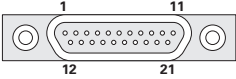
1. Change to the demo directory, for example:
`cd demos/c++/sdlviewer`.
2. Build the demo by typing `make`.
3. Start the demo by typing `./name_of_executable`.

5.4 Using Trigger and Strobe

Depending on your camera model, the pins for trigger and strobe are located on different connectors. The following tables show the different connectors and the corresponding pinouts for trigger and strobe. If you are not sure about the location of the connectors, please refer to ➔ 2.2 on page 10.

Single-Sensor Housing Cameras

Camera models: VRm(F)C-X-PRO

Connector	Pin	Signal
	1	GND
	2	Passive Strobe Out – (3...24 V)
	3	Passive Strobe Out + (3...24 V)
	4	Active Strobe Out (+5 V)
	5	GND
	6	Passive Trigger In – (3...24 V)
	7	Passive Trigger In + (3...24 V)
	8	Active Trigger In (+3.3...5 V)
	9	GND
	10...11	+5 V
	12...21	...

MPE Garry Micro-T 386-2-021-ZS0

Single-Sensor Board-Level Cameras, Remote-Sensor Cameras, Multi-Sensor Cameras

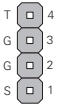
Camera Models: VRm(F)C-X-OEM/COB, VRmC-X-E, VRmMFC

Connector	Pin	Signal
	1...2	+5 V
	3	GND
	4...7	reserved
	8	GND
	9	Active Trigger In (+3.3...5 V)
	10	Active Strobe Out (+5 V)
	11...12	reserved
	13	GND
	14...15	reserved

Hirose DF14-15P

Compact Single-Sensor Board-Level Cameras

Camera models: VRmC-X+ OEM/COB

Connector	Pin	Signal
 4-pin header	1	Active Strobe Out (+5 V)
	2	GND
	3	GND
	4	Active Trigger In (+3.3...5 V)

5.4.1 Trigger Input

Passive Trigger Input (potential-free)

The passive trigger input accepts a positive voltage (3...24 V). The signal will be interpreted as logically high when the voltage exceeds 3 V, and as logically low when the voltage drops below 1 V. The current flowing between Trigger In + and Trigger In – is approx. 2 mA at 3.3 V and approx. 5 mA at 24 V. The active and the passive trigger input are connected internally and cannot be controlled separately.

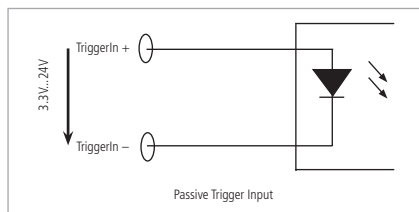


Fig. 16: Passive Trigger Input

Active Trigger Input (TTL)

An LVTTTL/TTL compatible signal can be fed in at the active trigger input in reference to GND. The input features an internal pull-down resistor, input current max. 1 mA.

5.4.2 Strobe Output

Passive Strobe Output (potential-free)

The camera switches an external current between Strobe Out + and Strobe Out – using a potential-free, opto-coupled output transistor. The voltage between Strobe Out + and Strobe Out – always has to be positive (3...24 V). The output transistor is capable of switching currents of up to 100 mA. The voltage drop across it will never fall below 1 V.

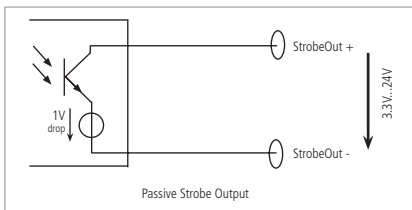


Fig. 17: Passive Strobe Output

Active Strobe Output (TTL)

At the active strobe out, a TTL compatible strobe signal is present in reference to GND. Active strobe out can sink or source currents of up to 20 mA.

6 Firmware Update

You should update your camera's firmware if a newer firmware version is available. A firmware update might be necessary, for example, for the camera to work with the latest SDK after you updated the SDK.



Warning!

Possible damage to the device

If you unplug the device while the firmware update is in progress, the device will not be functional anymore and may even be physically damaged.

Do not disconnect any device until the update is finished.

Updating the camera firmware:

1. Visit www.vrmagic.com/imaging/downloads/.
 - The firmware for USB cameras can be found below the heading "Software for USB Components".
2. Download the .zip file **VRmUsbCam Firmware Bundle X.Y**.
3. Unpack the file.
4. Connect the camera(s) you wish to update to your host PC and make sure they are detected, for example by using CamLab (➔ 5.2 on page 25).
5. Navigate to the folder you unpacked in step 3.
6. Run **vrmfwupd.exe** by double-clicking on it.
 - The Windows command line is displayed.

```
C:\Users\schoene\Downloads\VRmagic USB Camera Firmware Bundle 2.0\vrmfwupd.exe
VRmagic Firmware Updater v2.9.1.5                <c> VRmagic 2002-2012
-----
This tool will attempt to update all VRmagic devices currently
connected to the system. <1 device(s) found>

=====
IMPORTANT NOTICE
=====
You MUST NOT DISCONNECT any device while update is in progress,
otherwise the device will not be functional anymore or even
be physically damaged.

Continue? <y/n> ==> _
```

Fig. 18: VRmagic firmware updater

7. To start the update procedure, type <y> .
 - ▶ The update starts.
 - ▶ If the firmware is already up to date, an error is displayed and the update procedure is canceled.
8. Wait until all VRmagic USB devices have been updated and “Finished” is displayed.
 - ▶ You may now unplug the devices or continue working with them.

7 Appendix

7.1 Cable Plan VRmC-X OEM Interface Cable

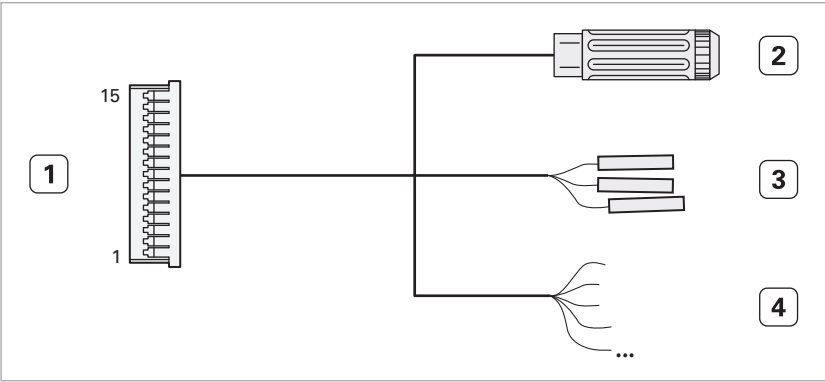


Fig. 19: VRmC-X OEM interface cable for OEM and COB cameras

- 1** Hirose DF14-15S-1.25C, to be plugged into camera receptacle
- 2** Switchcraft PC722A receptacle for 5 V power supply
- 3** Receptacles for 0.1" connector (3 pieces)
- 4** Open ends (8 pieces, reserved)

#2 pin	#3 wire	#4 wire	#1 pin	Signal
ring			3, 13	GND
center pin			1, 2	+5 V in / VBUS out
	gray		8	GND
	white		9	TTL TriggerIn (+3.3...5 V)
	black		10	TTL StrobeOut (+5 V)
		yellow1, green1, blue, purple, brown2, red2, yellow2, green2	4, 5, 6, 7, 11, 12, 14, 15	reserved

7.2 Cable Plan VRmDC/FC-X-DF14-Open



Fig. 20: VRmDC/FC-X-DF14-Open interface cable for OEM and COB cameras

- 1 Hirose DF14-15S-1.25C, to be plugged into camera receptacle
- 2 Open ends (15 pieces)

#2 wire	#1 pin	Signal
orange1, gray, orange2	3, 8, 13	GND
brown1, red1	1, 2	+5 V in / VBUS out
white	9	TTL TriggerIn (+3.3...5 V)
black	10	TTL StrobeOut (+5 V)
yellow1, green1, blue, purple, brown2, red2, yellow2, green2	4, 5, 6, 7, 11, 12, 14, 15	reserved

7.3 Cable Plan VRmC-X PRO Interface Cable

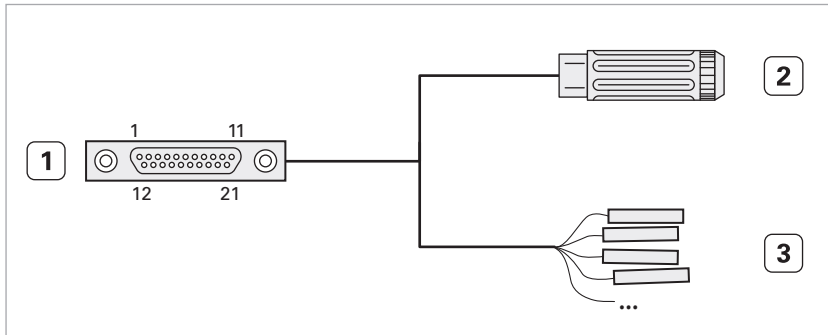


Fig. 21: VRmC-X PRO interface cable for PRO cameras

- 1** MPE Garry Micro-T 387-1-021-ZS0, to be plugged into camera receptacle
- 2** Switchcraft PC722A receptacle for 5 V power supply
- 3** Receptacles for 0.1" connector (7 pieces)

#2 pin	#3 wire	#1 pin	Signal
ring		5, 9	GND
center pin		10, 11	+5 V in / VBUS out
	white	1	GND
	brown	2	StrobeOut – (potential-free)
	green	3	StrobeOut + (potential-free)
	yellow	4	TTL StrobeOut (+5 V)
	gray	6	TriggerIn – (potential-free)
	pink	7	TriggerIn + (potential-free)
	blue	8	TTL TriggerIn (+3.3...5 V)

7.4 Pinout 4-pin Header VRmC-X+ OEM/COB

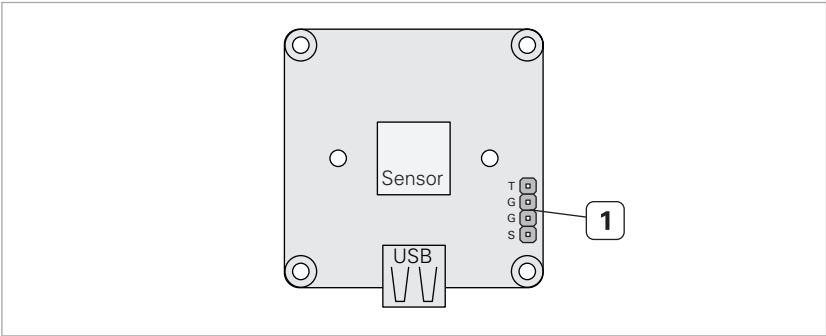


Fig. 22: 4-pin header of compact single-sensor cameras (OEM/COB)

1 4-pin header for trigger and strobe

#1 pin	Signal
T	TTL TriggerIn (+3.3...5 V)
G	GND
G	GND
S	TTL StrobeOut (+5 V)

7.5 Status LED Indications

**Note**

The compact single-sensor cameras with housing VRmC-X+ PRO do not have a status LED.

LED indication	Meaning
LED off	Device has no power or has entered USB suspend mode.
LED blinks	Device was not (yet) detected and the driver has not (yet) been loaded. This status typically occurs for a short time directly after connecting the device to the PC. Another reason for this status may be that the device is not supplied with sufficient power via the USB connection.
LED on (low brightness)	Device was detected and is operational (idle mode).
LED on (medium brightness)	Device is active and waiting for a trigger signal.
LED on (high brightness)	An image is currently captured or transferred to the PC. If the cameras is free-running, the LED glows in high brightness permanently (except if images are dropped occasionally).

8 Index

A

Accessories 13

B

Base unit 8, 9, 17

C

Cable plans 33

Cables 13

Flex-foil 17

VRmC-X OEM Interface Cable 13,
19, 20, 33

VRmC-X PRO Interface Cable 13,
21, 35

VRmDC/FC-X-DF14-Open 13, 19,
20, 34

CamLab 25

Connectors 10

Connect cables 19

DF14-15P 10, 19, 33, 34

MPE Garry Micro-T 11, 21, 35

E

External sensor board 9

F

Firmware update 31

FPGA board 7, 9

I

Interface board 7, 8, 9

Interfaces 10

M

Multi-Sensor Camera 9, 17, 22

P

Pinouts 33

Power supply 13, 22

external 23

via USB 23

R

Remote-Sensor Camera 8, 17

S

Sensor board 7

Sensor connection board 8, 9

Single-Sensor Camera 7

Compact 8, 22

Software 14

Download 14

Install 14

Status LED 10, 11, 23, 24, 25

Strobe 28, 30

T

Trigger 28, 29





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